IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Toru TSUKADA, et al.
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For: FEED SCREW DEVICE

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

VERIFICATION OF A TRANSLATION

I, the below named translator, hereby declare that:

My name and post office address are as stated below;

That I am knowledgeable in the English language and in the Japanese language and believe the attached English translation to be a true and complete translation of the certified copy of Japanese Patent Application No. Hei. 8-165546 filed in the U.S. Patent and Trademark Office on June 17, 1996.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false

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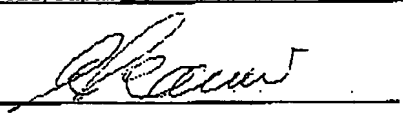
Signature of the translator: 

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[List of Attached Documents]

[Article]	Specification	1 copy
[Article]	Drawings	1 copy
[Article]	Abstract of the Description	1 copy

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[Title of Invention] SCREW TRANSMISSION DEVICE

[Claims]

[Claim 1] A screw transmission device comprising a screw axis, a nut member threadably engaging an outer periphery of the screw axis, and a ring-like lubricant supply device being disposed in the nut member with one axial end face opposed axially to the nut member and an inner peripheral surface opposed to an outer peripheral surface of the screw axis, wherein at least the portion of the lubricant supply device facing the screw axis is rubber or synthetic resin containing a lubricant, the improvement which comprises a press member having a portion opposed axially to an axial opposed end face of the lubricant supply device and being fixed to the nut member and a projection projecting from the press member to the lubricant supply device and inserted into the lubricant supply device.

[Claim 2] The screw transmission device according to claim 1, wherein at least two projections can also be provided and inserted into the lubricant supply device so that preload in the circumferential direction is put on the lubricant supply device as load.

[Detailed Description of the Invention]

【0001】

[Technical Field to which the Invention Belongs]

This invention relates to a screw transmission device

of a ball screw device, slide thread device, etc used in the working machine. Particularly, this inexertion relates to a screw transmission device having a feature in lubricant supply.

【0002】

A conventional ball screw device, a kind of screw transmission device, is described in Japanese Utility Model Laid-Open No. Hei 7-4952, etc., for example.

【0003】

This kind of ball screw device comprises a spiral thread groove 50a made in the outer peripheral surface of a screw axis 50 threadably engaging a spiral thread groove 51a made in the inner peripheral surface of a nut member 51 via a plurality of balls 52, as shown in Figure 10, for converting relative rotation of the screw axis 50 to the nut member 51 into relative displacement in an axial direction of the nut member 51 via the balls 52.

【0004】

An annular recess 53 is formed in both end parts of the inner diameter face of the nut member 51 (in Figure 9, only the right end is shown), and a sealing member 54 is mounted on the recess 53.

【0005】

A sealing member 54 is formed pf polymer member containing a lubricant like a ring, a projection 54a that can be fitted

into the thread groove 50a of the screw axis 50 projects from the inner peripheral surface of the sealing member 54.

【0006】

Further, a tapped hole 55 diametrically cut through is made in the position of the recess 53 in the nut member 51 and a set screw 56 is fitted into the tapped hole 55, thereby fixing the sealing member 54 to the nut member 51 by pushing the sealing member 54 to the screw axis 50 with a tip end of the axis portion of the tapped hole 55.

【0007】

The sealing member 54 prevents the lubricant filled in the ball screw device from leaking to the outside and a foreign material from entering the ball screw device from the outside.

Further, the lubricant exuding from the sealing member 54 decreases frictional resistance of the slide portion between the inner peripheral surface of the sealing member 54 and the outer peripheral surface of the screw axis 50, namely, slide torque and at the same time, is supplied to the thread groove 50a of the screw axis 50, the balls 52, and the thread groove 51a of the nut member 51.

【0008】

However, the conventional screw transmission device with the above-mentioned structure, although the set screw 56 has a function of setting the rotation of the sealing member 54

doe to the relative rotation of the screw axis 50 with respect to the nut member 51, the sealing member is partially deformed because a portion of the sealing member 54 is pushed diametrically. Therefore, it is feared that the sealing member 54 hits the screw axis 50 so that the lubricant cannot be supplied smoothly or the partial wear occurs.

【0009】

Even if a fitting for suppressing jump out of the sealing member 54 from the recess 53 is attached to the nut member 51, the tapped hole 55 needs to be made in the nut member 51 and fixed by the set screw 56 to prevent accompanying rotation of the screw axis 50 of the sealing member 54 in addition to the fitting; workability is poor.

【0010】

Further, when the sealing member 51 has a part cut because of attachment thereof, the inner peripheral surface of the sealing member 51 does not come in sufficient contact with the screw axis 50 and it is feared that a sufficient lubricant will be not supplied from the sealing member 51 depending on the operating condition.

【0011】

It is therefore an object of the invention to provide a screw transmission device for enable the lubricant supply device to jump out or rotate or supply the sufficient lubricant and in a simple means.

【0012】

To achieve the above-mentioned object, according to the screw transmission device comprising a screw axis, a nut member threadably engaging an outer periphery of the screw axis, and a ring-like lubricant supply device being disposed in the nut member with one axial end face opposed axially to the nut member and an inner peripheral surface opposed to an outer peripheral surface of the screw axis, wherein at least the portion of the lubricant supply device facing the screw axis is rubber or synthetic resin containing a lubricant, the improvement which comprises a press member having a portion opposed axially to an axial opposed end face of the lubricant supply device and being fixed to the nut member and a projection projecting from the press member to the lubricant supply device and inserted into the lubricant supply device.

【0013】

Further, according to the invention recited in claim 2, in the structure of claim 1, at least two projections can also be provided and inserted into the lubricant supply device so that preload in the circumferential direction is put on the lubricant supply device as load.

【0014】

In the invention, the device is sandwiched between the press member and the nut member, whereby an axial move of the lubricant supply device relative to the nut member is

restricted and the projection projecting from the press member prevents the lubricant supply device from rotating with the screw axis.

【0015】

That is, the press member having the projection is only fitted, an axial move and rotation of the lubricant supply device can be prevented.

As the screw transmission device is driven, a lubricant contained in the lubricant supply device exudes gradually over time, whereby slide resistance between the outer peripheral surface of the screw member and the inner peripheral surface of the lubricant supply device is decreased and as the screw transmission device is driven, a lubricant is supplied to the outer peripheral surface of the screw member.

【0016】

Here, a pair of the projections may be provided approaching each other and the projection span may be set smaller than the span between the paired projection insertion positions disposed in the lubricant supply device. In doing so, by sandwiching between the paired projections, preload in the circumferential direction is put as load and such a force to hold down the screw axis acts on the inner peripheral surface of the lubricant supply device.

【0017】

For example, a lubricant-containing polymer member

can be adopted as the lubricant supply device containing a lubricant according to the invention.

For example, the product manufactured in the following manner can be used as the lubricant-containing polymer member: Any of paraffin family hydrocarbon oil such as poly α-olefin oil, naphthene family hydrocarbon oil, mineral oil, ether oil such as dialkyl diphenyl ether oil, or ester oil such as phthalate ester or trimellitate ester is mixed as a lubricant with a polymer selected from the group consisting of polyolefin family polymers basically having the same chemical structure such as polyethylene, polypropylene, polybutylene, and polymethylpentane and the mixture is fused, then poured into a predetermined mold and cooled and fixed under pressure.

【0018】

Various additive agents such as an antioxidant, a rust preventive, a wear inhibitor, a defoaming agent, and an extreme pressure agent may be previously added to the mixture.

The percentage composition of the lubricant-containing polymer member may be set to 20%-80% by weight of polyolefin family polymer and 80%-20% by weight of lubricant with respect to all weight, because if the polyolefin family polymer is less than 20% by weight, hardness, strength, etc., required as the lubricant supply device cannot be provided and if the polyolefin family polymer exceeds 80% by weight (the lubricant is less than 20% by weight), lubricant supply lessens and the

slide torque reduction and lubricant supply effects decrease.

【0019】

The above-mentioned polymers have the same basic structure and differ in average molecular weight, covering the range of 1 X 10^3 to 5 X 6 Among the polymers, those of comparatively low molecular weight ranging from 1 X 10^3 to 1 X 6 and those of ultra high molecular weight ranging from 1 X 6 to 5 X 6 are used solely or mixed as required.

【0020】

To improve the mechanical strength of the lubricant supply device, the following thermoplastic resin and thermosetting resin may be added to the polyolefin family polymer:

【0021】

Resin such as polyamide, polycarbonate, polybutylene terephthalate, polyphenylene sulfide, polyether sulfone, polyether ether ketone, polyamide imide, polystyrene, or ABS resin can be used as the thermoplastic resin.

【0022】

Resin such as unsaturated polyester resin, urea resin, melamine resin, phenol resin, polyimide resin, or epoxy resin can be used as the thermosetting resin.

【0023】

The resins may be used solely or mixed.

Further, to disperse the polyolefin family polymer

and any other resin in a more uniform state, a proper compatibilization agent may be added as required.

【0024】

In addition to the polyolefin family polymer and lubricant combinations as described above, polyurethane rubber cured in a grease-containing condition can also be used as the lubricant-containing polymer, as described below in detail:

【0025】

Polyurethane rubber is a compound produced by reaction of polyisocyanate with an activated hydrogen compound.

Tolylene diisocyanate (TDI), hexamethylene diisocyanate (MDI), prepolymer (MW1000-MW2000) produced by reaction of TDI and MDI with an activated hydrogen compound, such as castor oil, or the like can be used as polyisocyanate.

【0026】

A long chain activated hydrogen compound such as hydrocarbon of polybutadiene, etc., polyether of polyoxypropylene, etc., caster oil or caster oil family polyol, polyester, or polycarbonate, a polyhydroxy compound such as water or ethylene glycol, or a short chain activated hydrogen compound such as polyhydroxy compound, amino alcohol, or polyamino compound can be used as the activated hydrogen compound.

【0027】

Normal grease such as mineral oil or lithium soap grease

can be used as the grease.

In this case, preferably the percentage composition of the lubricant-containing polymer member may be set to 80%-40% by weight of polyurethane rubber and 20%-60% by weight of grease with respect to all weight. If polyurethane rubber is less than 40% by weight, necessary hardness, strength, etc., cannot be provided. If polyurethane rubber exceeds 80% by weight (grease is less than 20% by weight), lubricant supply lessens and the slide torque reduction effect decreases.

【0028】

[Embodiments]

Referring now to the accompanying drawings, there are shown preferred embodiments of the invention. In the embodiments, feed transmission devices will be discussed by taking ball screw devices as examples. Of course, the description to follow goes for other screw transmission devices such as slide screw device.

【0029】

Figure 1 is an exploded perspective view to show the main part of a ball screw device according to a first embodiment of the invention and Figure 2 is a sectional view of the main part.

First, a general configuration of the first embodiment will be discussed. The ball screw device comprises a nut member 2 threadably engaged into a screw axis 1 having a spiral thread

groove 1a on an outer peripheral surface via a large number of balls 3. The nut member 2 is formed in an inner peripheral surface with a thread groove 2a corresponding to the thread groove 1a of the screw axis 1 and has a ball circulation passage (not shown) for guiding and circulating the balls 3 rolling in both the thread grooves 1a and 2a.

【0030】

A recess 4 for attaching a lubricant supply device is formed in both end faces of the inner diameter side of the nut member 2 coaxially with the nut member 2. Two tapped holes 5 are made in each of both the end faces of the nut member 2 with the axes parallel with the axis of the nut member 2. A lubricant supply device 6 is fitted into the recess 4 of the nut member 2 coaxially.

【0031】

The lubricant supply device 6 is a ring-like member having an outer diameter that can be fitted into the recess 4; for example, it is made of a material such as rubber or synthetic resin for producing a predetermined elastic force for providing flexibility and contains a lubricant such as grease or mineral oil.

【0032】

A lubricant supply device 6 has a cut part 6a for assembly in the circumferential direction and two insertion holes 7 made with the cut part 6a between. The two insertion holes

are paired and are made so as to extend in parallel with the axis of the lubricant supply device 6. In Figures 1 and 2, the insertion holes 7 are shown as through holes, but may be closed-end holes.

【0033】

Further, a fixed ring 8 for attaching the lubricant supply device 6 to a nut member 2 is included. It provides a press member with one surface facing the axial opposed end face of the lubricant supply device 6.

【0034】

The fixed ring 8 is a disk-like member having an inner diameter which is the same as the diameter of the nut member 2 and an inner diameter to place the fixed ring 8 out of contact with the outer peripheral surface of the screw axis 1. On the face opposed to the nut member 2, through holes 9 are made at positions corresponding to tapped holes 5 made in the nut member 2. Projections 10 projecting toward the lubricant supply device 6 are formed at positions corresponding to the insertion holes 7 of the lubricant supply device 6.

【0035】

The span between the two projections 10 is set slightly smaller than that between the paired insertion holes 7 In the embodiment, the projection 10 is formed by cutting a part of the fixed ring 8 and bending the part to the lubricant supply device 6. That is, the projections 10 are made by press working,

etc.

【0036】

First, the lubricant supply device 6 is fitted into a recess 4 of the nut member 2 and is inserted between the screw axis 1 and the nut member 2. In the state, one axial end face of the lubricant supply device 6 is opposed axially to the bottom face of the recess 4 of the nut member 2 and the inner peripheral surface of the lubricant supply device 6 is opposed diametrically to the outer peripheral surface of the screw axis 1.

【0037】

Successively, the projections 10 of the fixed ring 8 are inserted into the insertion holes 7 of the lubricant supply device 6 and set screws 11 inserted into the through holes 9 are threadably engaged into the tapped holes 5 with the outer periphery of the fixed ring 8 abutted against the end of the nut member 2 coaxially, whereby the fixed ring 8 is fixed to the nut member 2.

【0038】

Here, the lubricant supply device 6 is formed only of a lubricant-containing polymer, for example. To manufacture the lubricant supply device 6 for example, a lubricant-containing polymer is fused, then injected into a predetermined metal mold, pressurized, cooled and hardened, and molded. In this case, injection molding can be executed. For example, used

as the lubricant-containing polymer member is a mixture of polyethylene consisting of 20% by weight of low molecular weight polyethylene (molecular weight 1 X 10^3 to 5 X 10^5) and 10% by weight of ultra-high molecular weight polyethylene (molecular weight 1 X 6 to 5 X 6) and 70% by weight of paraffin family mineral oil as a lubricant.

【0039】

Next, the operation and effects of the ball screw device will be discussed.

When the screw axis 1 makes relative rotation to the nut member 2, balls 3 in the nut member 2 roll on a spiral space formed by the relative thread grooves 1a and 2a in the rotation direction of the screw axis 1 and circulate through a ball circulation passage (not shown). As the balls 3 roll, the nut member 2 is fed in the linear direction along the screw axis 1. The inner peripheral surface of the lubricant supply device 6 prevents the lubricant filled in the ball screw from leaking to the outside and also prevent a foreign material such as dust from entering the ball screw from the outside; the lubricant supply device 6 also serves as a sealing member.

【0040】

When the screw axis 1 makes relative rotation to the nut member 2 and the nut member 2 makes an axial move, rotation torque and an axially external force are applied to the lubricant supply device 6 as load.

However, in the embodiment, the lubricant supply device 6 is sandwiched axially between the bottom face of the recess 4 of the nut member 2 and the fixed ring 8 thus an axial move of the lubricant supply device 6 is blocked. Resultantly, jump out of the lubricant supply device 6 from the nut member 2 can be prevented.

【0041】

The projections 10 from the fixed ring 8 are inserted into the insertion holes 7 of the lubricant supply device 6 thus block rotation of the lubricant supply device 6 in the circumferential direction. Resultantly, when the screw axis 1 rotates, the lubricant supply device 6 does not rotate with the screw axis 1 and comes in sliding contact with the outer peripheral surface of the screw axis 1.

【0042】

At this time, since the lubricant supply device 6 contains a lubricant, the lubricant exuding gradually from the inner peripheral surface of the lubricant supply device 6 drastically reduces frictional resistance at the sliding time between the inner peripheral surface of the lubricant supply device 6 and the outer peripheral surface of the screw axis 1, so that slide torque lessens, preventing disturbance of drive of the ball screw and lessening the rotation force input to the lubricant supply device 6.

【0043】

Further, when the ball screw is driven, a lubricant exudes gradually from the inner peripheral surface of the lubricant supply device 6 with relative rotation of the screw axis 1 as described above, is supplied to the thread groove 1a of the screw axis 1, and uniformly covers the balls 3 rolling in the thread groove 1a and the thread groove 2a of the nut member 2 for stable lubrication over a long term.

【0044】

Therefore, if a lubricant is not supplied to the inside of the nut member 2 from the outside, the ball screw can continue good running for a long time at low torque. Since a lubricant need not be supplied to the inside of the nut member 2 from the outside, the ball screw can be used as effective lubrication means in a system that can use only an extremely small amount of lubricant, such as a semiconductor manufacturing system.

【0045】

Since the span between the projections 10 is set slightly smaller than that between the paired insertion holes 7 made in the lubricant supply device 6 the projections 10 inserted into the insertion holes 7 give such preload F to make the opposed faces between the cut parts 6a approach each other or press the opposed faces, as shown in Figure 3. As a result of the preload F, even if the lubricant supply device 6 contains a dimension error, such a force to hold the screw axis 1 acts, causing the inner peripheral surface of the lubricant supply

device 6 to come in reliable contact with the outer peripheral surface of the screw axis 1.

【0046】

At this time, the lubricant supply device 6 is not pressed diametrically for bringing the inner peripheral surface of the lubricant supply device 6 into contact with the outer peripheral surface of the screw axis 1 and such a force to hold the screw axis 1 causes the inner peripheral surface of the lubricant supply device 6 to come in contact with the outer peripheral surface of the screw axis 1. If the insertion holes 7 and the projections 10 are not made on all the periphery of the lubricant supply device 6 in the circumferential direction, all the inner peripheral surface of the lubricant supply device 6 can come in reliable contact with the screw axis 1. Moreover, the insertion holes 10 are only inserted into the insertion holes 7 of the lubricant supply device 6 thus the diameter of the nut member 2, namely, the outer diameter of the screw device is not enlarged.

【0047】

Thus, the fixed ring 8 having the projections 10 of a simple structure is only assembled, whereby jump out of the lubricant supply device 6 from the nut member 2 can be prevented, the lubricant supply device 6 can be prevented from rotating with the screw axis 1, and the inner peripheral surface of the lubricant supply device 6 can be brought into contact with

the outer peripheral surface of the screw axis 1.

【0048】

In the embodiment, although the span between the projections 10 is set slightly smaller than that between the paired insertion holes 7 so that preload F is applied to the lubricant supply device 6, it is not limited to this. In the case where the inner peripheral surface of the lubricant supply device 6 comes in contact with the outer peripheral surface of the screw axis 1 by the other method (pushing by gaster spring etc.), the preload F by the protrusion 10 needs no to be given.

【0049】

A pipe-like spacer may be previously inserted into the insertion hole 7 of the lubricant supply device 6 for preventing distortion between the projection 10 and the insertion hole 7 when rotation force is input.

【0050】

In the embodiment, a set of a pair of insertion holes and a pair of projections is taken as an example, but a set of two or more pairs of insertion holes or three or more insertion holes and two or more pairs of projections or three or more projections may be provided.

【0051】

Next, a second embodiment of the invention will be discussed. Members identical with or similar to those

previously described in the first embodiment are denoted by the same reference numeral.

The basic configuration of a ball screw device of the embodiment is similar to that of the first embodiment, as shown in Figures 4 and 5.

【0052】

However, a plurality of lip parts 20 are projected along the circumferential direction toward the inner peripheral surface of a lubricant supply device 6 and come in sliding contact with the outer peripheral surface of a screw axis 1.

A fixed ring 8 providing a press member has an outer diameter set slightly larger than the diameter of a recess 4 of a nut member 2 and has a part cut in the circumferential direction in place of a through hole 9. A pair of mounting holes 8b is made in the proximity of the cut part 8a.

【0053】

A ring-like fit groove 21 into which the fixed ring 8 can be fitted is formed in the inner peripheral surface of the recess 4 of the nut member 2.

After the lubricant supply device 6 is engaged into the recess 4, the fixed ring 8 is fitted into the fit groove 21 in the recess 4. To fit the fixed ring 8 the mounting holes 8b are used to lessen the distance between the opposed faces of the cut part 6a for reducing the diameter of the fixed ring 8. In this state, the fixed ring 8 is inserted into the recess

4.

【0054】

Also in this case, projections 10 of the fixed ring 8 are inserted into insertion holes 7 of the lubricant supply device 6.

Other components and the function and effects of the embodiment are similar to those of the first embodiment. 【0055】

However, the portions of the lubricant supply device 6 coming in contact with the screw axis 1 are formed as the lip parts 20 and interference is provided, whereby the inner periphery of the lubricant supply device 6 comes in reliable contact with the outer peripheral surface of the screw axis 1 if preload F, etc., is not given. Thus, the preload F need not be given.

【0056】

If the interference state is set, the lip parts 20 warp, so that press pressure put on the outer peripheral surface of the screw axis 1 is set small; no problem arises.

In the second embodiment, the lubricant supply device 6 is engaged into the nut member 2, thus set screws are not required.

【0057】

Next, a third embodiment of the invention will be discussed. Members identical with or similar to those

previously described in the first embodiment are denoted by the same reference numerals.

The basic configuration of a ball screw of the embodiment is similar to that of the first embodiment.

【0058】

However, a plurality of lip parts 20 are provided along the circumferential direction toward the inner peripheral surface of a lubricant supply device 6 whereby preload F need not be given, reducing the number of projections 10 formed on a fixed ring 8 to one.

【0059】

Other components and the function and effects of the embodiment are similar to those of the above-described embodiment.

To balance mounting, a set of insertion hole 7 and projection 10 may also be made at points shifted 180 degrees in the circumferential direction.

【0060】

The lubricant supply devices of the embodiments may have no projections on the inner peripheral surface or may be provided with a plurality of lip parts 20. However, the invention is not limited to them. For example, a spiral projection 6b that can be fitted into the thread groove 1 of the screw axis 1 may be made on the inner peripheral surface of the lubricant supply device, as shown in Figure 7.

【0061】

Next, a fourth embodiment of the invention will be discussed. Members identical with or similar to those previously described in the first embodiment are denoted by the same reference numerals.

The basic configuration of a ball screw of the embodiment is similar to that of the above-mentioned embodiment, as shown in Figure 8.

【0062】

However, without forming a nut member 2 with a recess 4, a press member 25 is formed like a cap and a lubricant supply device 6 is housed in the cap-like press member 25. At this time, a bottom 25a of the cap-like press member 25 is opposed axially to the axial opposed end face of the lubricant supply device 6.

【0063】

Other components and the function and effects of the embodiment are similar to those of the above-described embodiment.

However, in the embodiment, the nut member need not be formed with the recess 4.

A projection 10 is made on the bottom 25a opposed axially to the lubricant supply device 6 as in the above-described embodiment, but the invention is not limited to it. For example, it may be made on a circumferential wall portion 25b opposed

to the lubricant supply device 6 in the circumferential direction 6.

【0064】

In the embodiments, a part of the press member of the fixed ring, etc., is cut and the cut part is bent for forming the projection. However, the invention is not limited to it. For example, the projection may be formed by welding etc., on the face opposed to the lubricant supply device or a hole may be made in the press member and a bar-like member may be attached to the hole as a projection. However, if the projection is formed by cutting a part of the press member and bending the cut part as described above, it can be manufactured by press working easily and at low costs.

【0065】

In the embodiments, the insertion holes are made in the lubricant supply device and the projections are inserted into the insertion holes. However, the invention is not limited to it. For example, without making the insertion holes 7 in the lubricant supply device 6 and with the tips of the projections 10 sharpened, the projections may be stuck into the lubricant supply device 6 for insertion. At this time, to put preload in the circumferential direction as load, the projections 10 may be stuck into the lubricant supply device 6 with the lubricant supply device 6 warped in the circumferential direction.

【0066】

In the embodiment, the lubricant supply device 6 also serves as a sealing member, but a separate sealing member may be provided.

The lubricant supply device 6 may be divided into parts along the circumferential direction. That is, the lubricant supply device may be like a ring as a whole. In this case, projections may be provided so as to connect the divisions or corresponding to the divisions.

【0067】

Further, the portion of the lubricant supply device 6 coming in contact with the screw axis 1 may be a plurality of lip parts 30 axially arranged, as shown in Figure 9.

【0068】

[Effect of the Invention]

As we have discussed, when the screw transmission device of the invention is driven, a lubricant in the lubricant supply device exudes gradually with rotation of the screw axis and is automatically supplied to the screw transmission device. Resultantly, if a lubricant is not supplied from the outside, the screw transmission device can continue good running for a long time at low torque.

【0069】

Particularly, since a lubricant need not be supplied from the outside within the nut member, the screw transmission device can be used as effective lubrication means in a system

that can use only an extremely small amount of lubricant, such as a semiconductor manufacturing system.

【0070】

Moreover, in the screw transmission device of the invention, by using the press member with the protrusion jump out of the lubricant supply device from the nut member and rotation with the screw axis can be prevented.

【0071】

Further, by using the invention recited in claim 2, the inner diameter of the lubricant supply device is reduced by simple means for uniform contact with the screw axis; a lubricant can be supplied well and wear on one side can be prevented.

[Brief Description of the Drawings]

[Fig. 1]

Figure 1 is an exploded perspective view to show the main part of a ball screw device according to a first embodiment of the invention;

[Fig. 2]

Figure 2 is a sectional view to show the main part of the ball screw device according to the first embodiment of the invention;

[Fig. 3]

Figure 3 is an illustration to explain the functions of projections and insertion holes according to the first

embodiment of the invention;

[Fig. 4]

Figure 4 is an exploded perspective view to show the main part of a ball screw device according to a second embodiment of the invention;

[Fig. 5]

Figure 5 is a sectional view to show the main part of the ball screw device according to the second embodiment of the invention;

[Fig. 6]

Figure 6 is an exploded perspective view to show the main part of a ball screw device according to a third embodiment of the invention;

[Fig. 7]

Figure 7 is a sectional view to show another example of lubricant supply device;

[Fig. 8]

Figure 8 is a sectional view to show the main part of a ball screw device according to a fourth embodiment of the invention;

[Fig. 9]

Figure 9 is a sectional view to show an inner diameter part of another example of lubricant supply device; and

[Fig. 10]

Figure 12 is a fragmentary sectional view to show the

main part of a conventional ball screw device.

[Description of Reference Numerals and Signs]

F preload

1 screw axis

1a thread groove

2 nut member

2a thread groove

3 ball

4 recess

5 tapped hole

6 lubricant supply device

7 insertion hole

8 fixed ring

10 protrusion

[Name of Document] Abstract of the Disclosure

[Abstract]

[Object] To provide a screw transmission device for enabling the lubricant supply device 6 to jump out or rotate in a simple means.

[Solving Means]

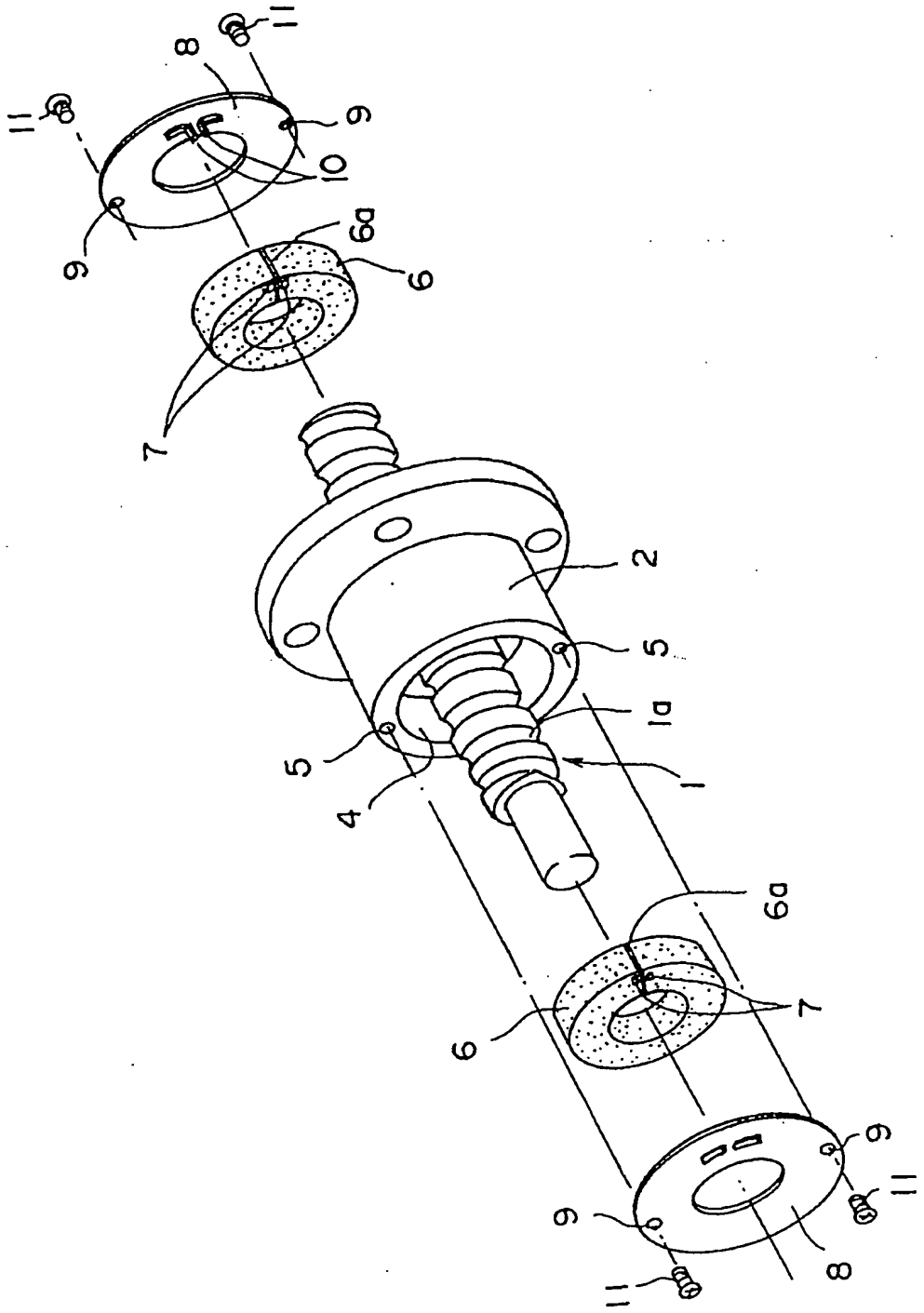
A nut member 2 is threadably engaged into a screw axis 1 via a large number of balls 3. A lubricant supply device 6 is attached to a recess 4 of the nut member 2. The lubricant supply device 6 is a ring-like member having an outer diameter that can be fitted into the recess 4 and contains a lubricant such as grease or mineral oil. The lubricant supply device 6 has a cut part 6a for assembly in the circumferential direction and two insertion holes 7 made with the cut part 6a between. Fixed rings 8 are opposed each other in an axial direction at the end surfaces in the axial direction of the lubricant supply device 6. The fixed ring 8 is provided with a protrusion 10 protruding to the lubricant supply device 6.

[Selected Drawing]

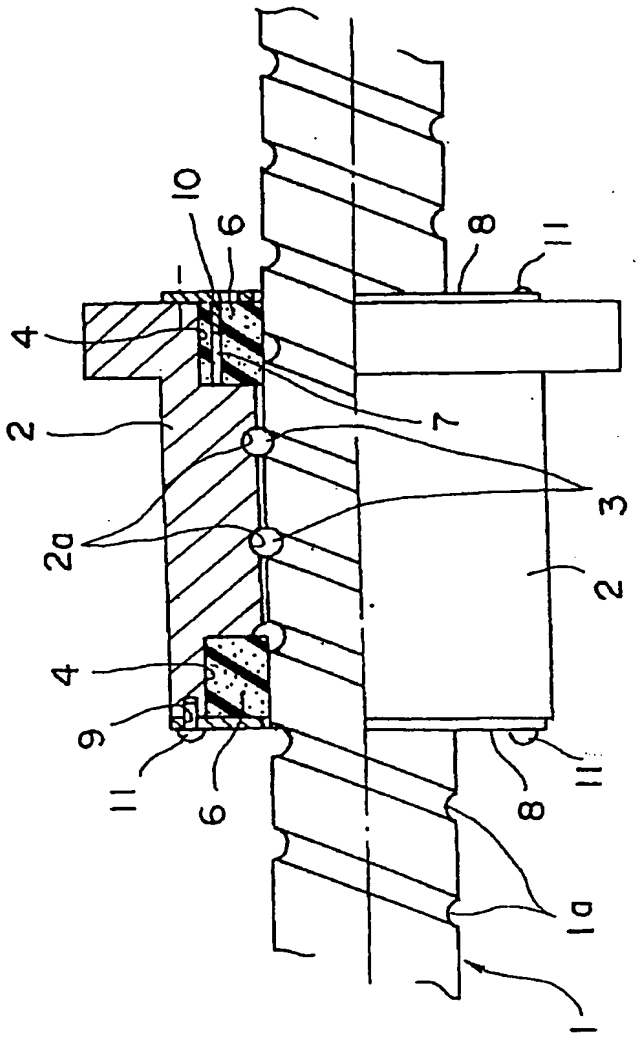
Fig. 1

【書類名】 図面 Drawing

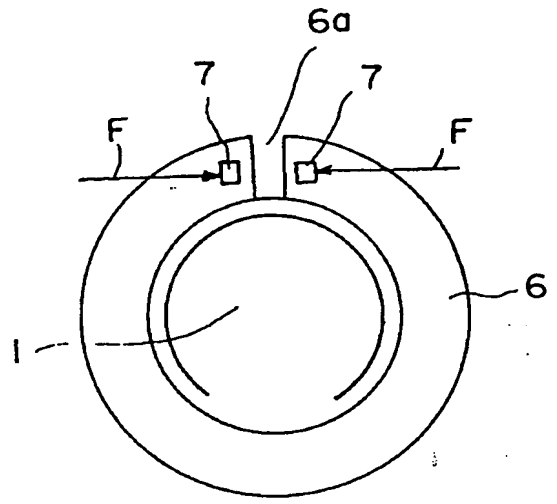
【図1】 Fig 1



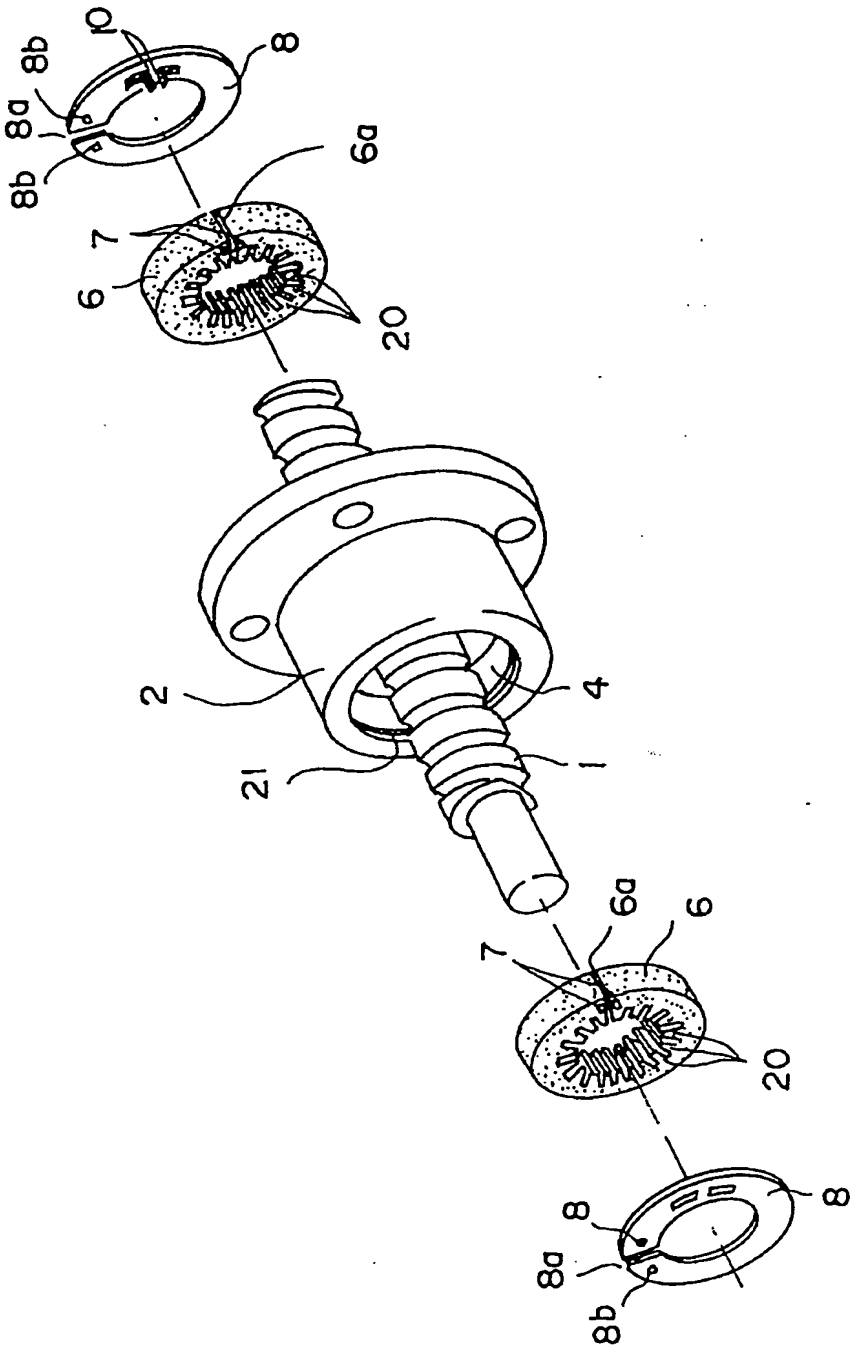
【図2】 Fig 2



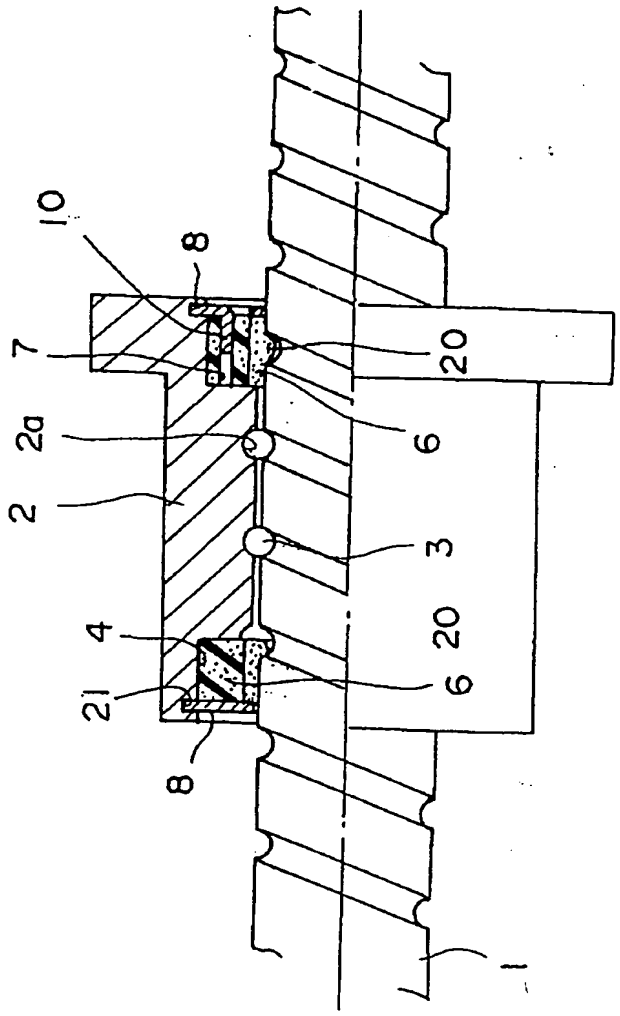
【図3】 Fig 3



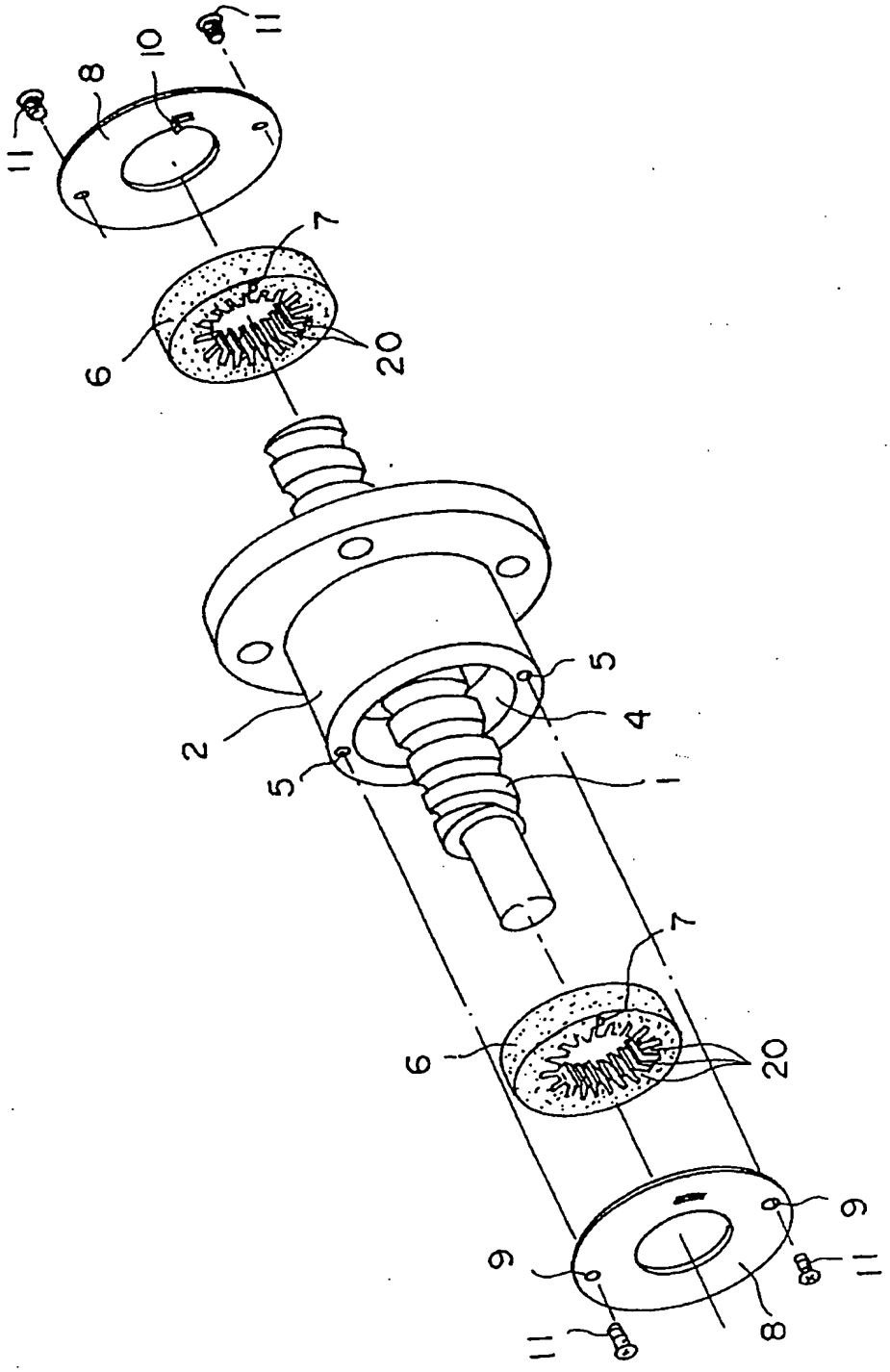
【図4】 Fig 4



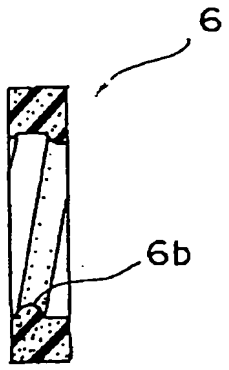
【図5】 Fig 5



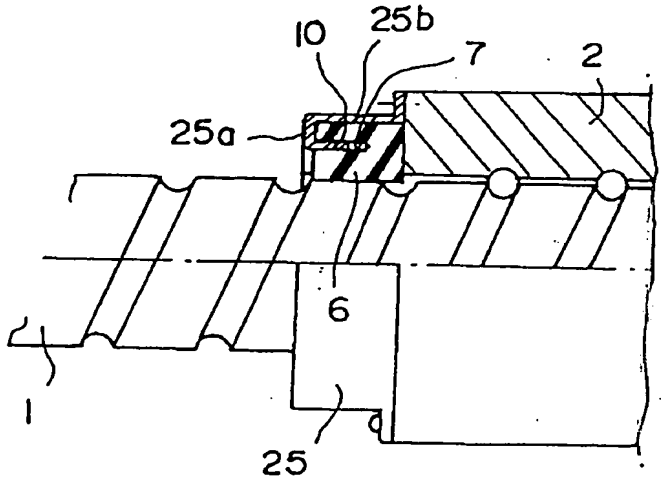
【図6】 Fig 6



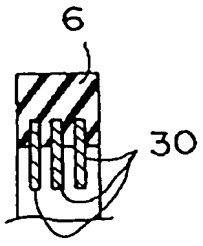
【図7】 Fig 7



【図8】 Fig 8



【図9】 Fig 9



【図10】 Fig 10